Team Boza

TOWER EDU-FENSE

Project Requirements Document

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Release Date
September 9th, 2024

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Executive Summary

TOWER EDU-FENSE is a tower defense game with heavy educational components targeted at the elementary school level. TOWER EDU-FENSE is intended to teach math, geography, and chemistry while providing a fun and rewarding experience to all players. The game will be designed to be visually pleasing while having a robust gameplay design that has customizable difficulty via the game maps' designs. The software will be straightforward and the targeted demographic of young children will have no challenges with using it.

This document provides nontechnical information regarding the purpose and behavior of TOWER EDU-FENSE.

Document Versioning

Date	Owner	Comment
9/2/2024	Everyone	Wrote up project requirements
9/5/2024	Zachary	Finished 2D array for Easy Map
9/5/2024	Owen	Implemented question features and question txt files
9/6/2024	Brooktie	E.2 (Level select) finished
9/6/2024	Brooktie	Ux.1 (GUI support) finished
9/6/2024	Owen	Implemented test suites for Question class
9/7/2024	Zachary	Finished Normal, Hard, and EXTREME Map
9/7/2024	Zachary	E.5 (Game grid) finished
9/8/2024	Andrew	Finished first version of Tower and Enemy classes.
9/8/2024	Everyone	GitHub repository reorganized and initial code integration process started
9/9/2024	Everyone	Implemented/Integrated question features, map layouts, and GUI onto a main class
9/9/2024	Zachary and Owen	Updated Project Requirements to reflect v2 goals.

Project Description

Team Boza's incredible idea to enter the game marketing space while tapping into basic educational fields is brought to life through TOWER EDU-FENSE. This game is intended to be a staple of the educational/game market. TOWER EDU-FENSE provides a seamless integration of tower-defense gameplay with core educational subjects such as math, geography, and chemistry, designed specifically for elementary school students to learn while having fun.

The game is engineered to be highly engaging and visually appealing, ensuring that the learning experience is fun and rewarding. With intuitive controls and an interface tailored for youngsters, TOWER EDU-FENSE allows children to play independently without parental supervision. The game's design includes customizable difficulty settings and educational content that adapts to different learning stages, enabling personalized learning paths and usage in educational environments such as school!

TOWER EDU-FENSE does not require any network connectivity, allowing it to be played anywhere at any time as long as the user has JDK installed onto their computer. Additionally, while TOWER EDU-FENSE is focused on gameplay, its backend design will support the integration of additional educational modules or features, ensuring the game remains a relevant and effective learning tool as educational standards and technologies evolve.

TOWER EDU-FENSE is distinct in its focus not only on providing entertainment but also on fostering educational growth, aiming to fill a significant gap in the current educational game market.

Features

The feature matrix enumerates the features requested for the project and the discussion section provides details regarding the intent of the feature. The ids will be used for traceability. Features that all stakeholders have agreed can be removed should strike-through the feature id and have a comment added to discuss the feature being dropped.

Priority Codes:

H - High, a must have feature for the product to be viable and must be present for launch
M - Medium, a strongly desirable feature but product could launch without
L - Low, a feature that could be dropped if needed

Feature Matrix

ID	Prio.	Feature Name	Owner	Comment
~~s.1~~	~~H~~	~~Compatibility with Java Platforms~~	~~Everyone~~	All coders have been working in Java and GUI is created using built-in Java features.
s.2	M	Easy to use for all ages	Everyone	
s.3	L	Simple to distribute	Everyone	
~~ux.1~~	~~H~~	~~GUI support~~	~~Visual Design~~	Completed by Brooktie
ux.2	H	GUI conditions	Visual Design	
ux.3	M	Error messages	Programming	
e.1	H	Fixed game loop	Game Design	
~~e.2~~	~~H~~	~~Level Select~~	~~Programming~~	Completed by Brooktie
e.3	H	Enemy	Game Design	
e.4	H	Towers	Game Design	
~~e.5~~	~~H~~	~~Game grid~~	~~Programming~~	Completed by Zachary
~~e.6~~	~~H~~	~~Question interface~~	~~Programming~~	Completed by Owen
e.7	M	In-game	Design	

		on-screen menu		
e.8	H	Waves per Level	Game Design	
e.9	H	Buttons	Programming	
e.10	H	Currency	Game Design	
~~e.11~~	~~L~~	~~Game Speed Button~~	~~Programming~~	Requirement no longer needed due to shift in game design
e.12	M	Game Completion Tracking	Programming and Visual Design	

Feature Discussion

S.1 - Compatibility with Java platforms

To support marketing and expand potential market penetration, TOWER EDU-FENSE should be able to run on any machine that has Java installed and should not require any further software installations beyond that and the executable file.
(Not sure what this would look like… any computer with java? Would it need a compiler?)

S.2 - Easy to use for all ages

As TOWER EDU-FENSE is primarily made for elementary school children, it should be easy to use and uncomplicated to understand. No overly complex directions or mechanics should be utilized.

S.3 - Simple to distribute

The final executable file should be easy to install and should have an in-depth README that ensures that all users, regardless of their familiarity with technology and the game itself, can install and run the game.

UX.1 - GUI support

To create a game with youth-friendly images and GUI. It should be colorful and the pop-up screens should be organized and spaced clearly throughout the menus to avoid any confusion with how to operate the game.

UX.2 - GUI conditions

Ensure all GUI window portions on the in-game screen can be used simultaneously and that text input boxes and buttons do not interrupt/pause the main game.

UX.3 - Error messages

When TOWER EDU-FENSE encounters issues that make the game unable to run/load/proceed, an error message of a suitable format for a player with no ability to make any changes to the game should be displayed and the game should stop.

E.1 - Fixed game loop

This requirement was introduced by development to manage scope and provide a clear vision for the implementation of the TOWER EDU-FENSE. The game will use the following loop…

1. Display the world map
    The world has 3 islands: Math, Geography, Chemistry
2. Execute the player's difficulty choice by loading the respective game map
    Difficulty is derived from the "length" of the game map's path (no questions difficulty)
    A map with a path that is a straight line would be the most extreme difficulty
3. Begin spawning enemies for wave 1/20 upon player pressing "Start Wave"
    There are a set quantity of enemies that spawn per wave, if an enemy reaches the exit the player loses and must restart
4. Add currency to the player's total upon successfully answering educational questions
    This occurs in parallel with the tower defense game, on a section of the GUI that is simultaneously on the screen
5. Place towers onto the desired location on the game grid when the player presses the tower button and has sufficient currency
    Towers cannot be placed on the enemy path
6. Display an exciting win screen upon completion of all 10 waves and update the backend database to track the completion of said island at said difficulty

E.2 - Level select

Players should be able to choose different modes (types of questions) and difficulty (map design) to curate their playing experience to their own skill and knowledge level.

E.3 - Enemy

Enemies represent the non-player-characters that are trying to reach the exit, which will subtract player health. They have a predetermined amount of health points and attributes depending on their type, and each enemy takes away 1 player life upon reaching the exit.

E.4 - Towers

Towers represent in-game characters that the user will purchase with their in-game currency levels. There will be multiple types of towers that vary based on cost and ability. More expensive towers will be more effective against the enemy.

E.5 - Game grid

The game grid is located in the center of the GUI and comprises a 17x17 set of buttons that are locations that allow for towers to be placed. The enemy's path comprises grid locations that do not allow for towers to be placed.

E.6 - Question interface

Educational questions are displayed on the left side of the in-game GUI and players can use their keyboard to input answers to the educational questions that are based on the island type. For example, for the geography island, the player will be asked what the capital of Vermont is, and they will be expected to input "Montpelier".

E.7 - In-game on-screen menu

This would represent a menu screen at the bottom of the main game window, containing the user's stats such as currency levels, enemies defeated, and time played, as well as a pause button and an exit to main menu button. For example, if the pause button is pressed the game will effectively pause until the user decides to resume. If the menu button is pressed, the game will pause and a pop-up window will appear with a yes and no button, indicating if the user is sure they want to exit to the main menu.

E.8 - Waves per level

Tentatively, there will be 20 waves per level, with the waves getting progressively harder. Ideally, if there is enough time during development, there will be a "boss" enemy on the final wave.

E.9 - Buttons

The grid is made of "disguised" buttons. Once a tower is selected, the grid is activated and the player is able to place the tower on the grid.

E.10 - Currency

This is the money that the player will be able to use to purchase new towers. The player will also earn more currency upon successful completion of questions.

~~E.11 - Game speed button~~

For usability and convenience, a button will allow the player to control the speed of the game, which would make towers fire faster as well as the enemies approach quicker (e.g. 2X speed). This is a low-priority feature as it may be extremely difficult to implement depending on how the codebase is structured while not being essential to the game's functionality.

E.12 - Game completion tracking

In order to create a sense of progression and accomplishment, players are awarded “ribbons” on the world map interface for each island they successfully complete at each difficulty level. The player will also have a button on the world map that allows them to wipe their local progress.

User Stories

The primary users of TOWER EDU-FENSE are video game players interested in testing their knowledge of basic subjects. There can be different types of players using TOWER EDU-FENSE, for example, technology novices, elementary school children, and serious gamers.

Lisa, a elementary school student
Lisa is 8 years old. She loves playing games of all kinds and forms and gets super excited about tower defense games. Lisa wants to complete all the levels of the game while learning about state capitals and the multiplication table.

Max, high school student
Max is 16 years old, and he is just learning about the periodic table of elements. He wants to find a fun way to study and memorize the periodic table.

Jane, a teacher
Jane is teaching her class the multiplication table. She wants to find a medium to get more engagement from her students while being able to have them learn it in a way that is fun.

To support all these users reliably, the system needs to be flexible enough to support a range of features. This needs careful consideration of how TOWER EDU-FENSE users might use the system and TOWER EDU-FENSE can create a user-friendly and straightforward interface so its users have the best gaming experience while maintaining the educational goal for its users.

The following use cases describe goals, criteria for success, and potential extensions for failures:

Use Cases

Use Case 1

Use Case Name	Unlocking Achievements/Ribbons
Summary	Allow players to earn ribbons for completing each map at different difficulty levels to provide a sense of accomplishment and to visually track progression through the game.
Rationale	This feature will engage players by rewarding their skill and dedication, encouraging them to explore all aspects of the game and achieve mastery over its challenges.
Users	Players/Gamers/Completionist
Preconditions	- The player has access to the game. - Levels and difficulty settings are implemented and functional.
Course of Events	**1.** Player chooses a map and a difficulty level to play from the game menu. **2.** Player completes the map at the selected difficulty. **3.** The game checks if this is the first completion at this difficulty for this map. **4.** If it is a new achievement, the game awards a ribbon that appears in the player's profile or on a dedicated achievements page. **5.** The game updates the player’s progress, visually indicating the new ribbon and any related achievements.
Alternative Paths	If the player has already earned a ribbon for that map and difficulty, notify them of the duplicate achievement without awarding a new ribbon. If the player completes a higher difficulty, they automatically receive ribbons for lower difficulties not yet completed.
Expectations	Players will be motivated to try completing all maps at all difficulty levels. The visual representation of achievements will help players track their progress and set personal goals.
Postconditions	The player's achievements are updated with new ribbons as they complete each challenge. The game displays an updated count and visual representation of all earned ribbons.

Use Case 2

Use Case Name	Varying Levels of Difficulty or Topics
Summary	Implement varying levels of difficulty or topics within the game.
Rationale	Students can progress to more challenging content once they master easier topics, ensuring continuous engagement and learning.
Users	Elementary School Students
Preconditions	Basic educational content is already implemented in the game.
Course of Events	1. The game presents the student with different levels of difficulty or topics. 2. The student selects the appropriate level or topic based on their proficiency. 3. The game adjusts the content accordingly and presents educational challenges.
Alternative Paths	The game may automatically adjust the difficulty based on the student's performance.
Expectations	Students may select a level that is too difficult or too easy, leading to frustration or boredom.
Postconditions	The student is able to engage with educational content that matches their learning level.

Use Case 3

Use Case Name	Learning Through Gameplay to Unlock Towers and Upgrades
Summary	Integrate educational problem-solving as a mechanic to unlock new towers and upgrades.
Rationale	Students can progress in the game while improving their math skills, blending education with entertainment.
Users	Elementary School Students
Preconditions	The game already includes basic tower defense mechanics.
Course of Events	1. The game presents the student with math problems during gameplay. 2. The student solves these problems to unlock new towers and upgrades. 3. The game integrates these new towers and upgrades into the gameplay.
Alternative Paths	Towers and upgrades could be unlocked through a combination of educational achievements and in-game currency.
Expectations	The educational content may be too difficult, preventing the student from progressing in the game.
Postconditions	The student improves their math skills and gains new towers and upgrades to enhance their gameplay experience.

Use Case 4

Use Case Name	Ensuring Content Appropriateness
Summary	Ensure all game content is age-appropriate and free of explicit material, providing a safe and enriching environment for children to learn and play.
Rationale	To give parental figures and teachers confidence that the game is a suitable and beneficial educational tool for children.
Users	- Parental Figures - Teachers
Preconditions	- The game has implemented features for content filtering and monitoring. - Systems are in place to categorize and flag content based on age appropriateness.
Course of Events	**1.** Parent/Teacher reviews the game settings to adjust content filters according to the child's age group. **2.** The game filters and presents only appropriate content during gameplay, ensuring all displayed material matches the set preferences. **3.** Parents/Teachers are notified of any updates or changes to content guidelines or categories within the game. **4.** The game periodically reassures the Parent/Teacher through notifications or in-app messages about the content appropriateness. **5.** Parents/Teachers can access a dedicated section in the game or on the game's website to review detailed content descriptions and the educational value of game elements.
Alternative Paths	- Parents or teachers might be able to request a review of certain game contents if they believe it to be inappropriate, triggering a re-evaluation by the game developers. - In case of any content being flagged by parents or teachers as inappropriate, the game developers promptly review and modify the content if necessary.
Expectations	- The game remains a trusted tool for education without exposing children to unsuitable content. - Parents and teachers frequently use the monitoring tools provided to stay engaged with the children's interactions with the game.
Postconditions	- The game consistently adheres to high standards of content appropriateness as verified by parental and teacher feedback. - Parents and teachers are continuously informed and reassured about the educational quality and safety of the game content.

Use Case 5

Use Case Name	Unlock Special Towers Through Chemistry-Related Questions
Summary	Enable students to unlock special towers by correctly answering questions related to the periodic table and atomic symbols.
Rationale	This feature helps middle school students strengthen their chemistry knowledge, particularly their understanding of the periodic table, while engaging in gameplay, enhancing both their academic skills and game experience.
Users	Middle School Students
Preconditions	- The game includes a quiz mechanism for chemistry-related questions. - Educational content about the periodic table and atomic symbols is integrated into the game.
Course of Events	**1.** The game presents periodic table-related questions at certain stages or upon achieving specific milestones. **2.** Students answer the questions to demonstrate their knowledge of atomic numbers, symbols, and properties of elements. **3.** Upon answering correctly, special towers or game features that are themed around chemistry concepts are unlocked, enhancing the gameplay. **4.** Feedback is given on both correct and incorrect answers, with brief educational snippets to reinforce learning.
Alternative Paths	- If a student answers incorrectly, the game could provide hints or additional chances to answer again before progressing, reducing potential frustration. - Special towers and features could also be unlocked through cumulative points earned from correct answers over multiple games, ensuring ongoing engagement.
Exceptions	Some students may struggle with advanced chemistry questions; thus, an option to adjust the difficulty or receive simplified explanations could be provided.
Postconditions	- Students improve their understanding of the periodic table, reflected in both their game performance and academic performance. - The game is recognized by students and educators as a practical and enjoyable educational tool for learning chemistry.

Use Case 6

Use Case Name	Mastering U.S. Capitals Through Interactive Gameplay
Summary	Provide a fun and engaging platform for high school students to review and test their knowledge of all 50 U.S. state capitals, making the review process more enjoyable and less tedious.
Rationale	Interactive gameplay that incorporates educational quizzes on U.S. state capitals helps students prepare for AP Human Geography by enhancing retention and engagement.
Users	Students HighSchool
Preconditions	- The game includes a comprehensive database of questions about U.S. state capitals. - Features are in place for tracking progress and adapting questions based on student performance.
Course of Events	**1.** Students select the U.S. state capitals module from the game's main menu. **2.** The game presents questions about U.S. state capitals as part of the gameplay, asking students to identify capitals for given states or vice versa. **3.** Students submit their answers using an interactive interface within the game. **4.** Immediate feedback is provided after each answer, highlighting correct responses and offering concise explanations or memorable facts for incorrect ones. **5.** Progress is tracked, with students able to view their performance statistics and review areas where they need improvement.
Alternative Paths	- The game might include a "challenge mode" or “test mode” where students can face timed quizzes to simulate the pressure of an actual test environment, enhancing their readiness for timed exams. - Students who consistently perform well could possibly unlock additional levels or bonus content, motivating them to continue using the tool for study.
Expectations	- Students find the game to be a valuable and effective method of studying for their geography exams, leading to improved scores and deeper understanding. - The game's format makes studying less monotonous and more engaging, increasing the frequency and duration of study sessions
Postconditions	- Students have enhanced their knowledge of U.S. state capitals.

	- The game is recognized by both students and educators as an effective supplementary tool for AP Human Geography preparation.

Use Case 7

Use Case Name	Enhanced Strategy and Resource Management in Tower Defense Levels
Summary	Enhance tower defense levels to include complex strategic elements that challenge players to make intelligent choices regarding the distribution of in-game currency and resources, thereby increasing the sense of achievement upon overcoming these challenges.
Rationale	This feature appeals to strategic gamers who seek more than just entertainment from gameplay; they look for opportunities to test and improve their tactical skills, making the game both challenging and rewarding.
Users	Players (Strategic Gamer)
Preconditions	The game features a functioning tower defense mechanism. Systems are in place to allow for variable difficulty levels and resource management.
Course of Events	**1.** Player starts at a challenging level where resource management is critical. **2.** During the level, the player must make decisions on how to allocate limited in-game currency to build, upgrade, or save for future rounds. **3.** The game presents increasingly difficult waves of enemies, requiring the player to adapt their strategy based on available resources and enemy types. **4.** Feedback on player decisions is immediate and impactful, showing the consequences of their strategic choices in real-time. **5.** Completion of a level after overcoming the odds results in a significant sense of achievement and possibly unlocks special awards or achievements.
Alternative Paths	- If the player fails a level, they could receive tips or suggestions for alternative strategies and have the option to retry the level. - For an added challenge, certain levels might introduce random events that can affect resource availability or enemy strength, forcing players to adapt quickly.
Expectations	- Players are engaged by the challenge and complexity of the game, leading to longer play sessions and deeper involvement.

	- The difficulty and strategy required can lead to a highly rewarding experience, encouraging players to continue improving their ta
Postconditions	- Players have developed and refined their strategic thinking and resource management skills. - The game is recognized for its challenging and intellectually stimulating gameplay, attracting a community of strategic gamers.

Use Case 8

Use Case Name	Learn U.S. States and Capitals as an International Student
Summary	Enable players, specifically international students, to learn and master U.S. states and capitals through interactive tower defense gameplay, enhancing their geographical knowledge as they progress through levels.
Rationale	This feature aims to provide an engaging educational tool for international students to familiarize themselves with U.S. geography in a fun and memorable way.
Users	International Students
Preconditions	The player has started the game and has access to levels that include geographical content. Educational content about U.S. states and capitals is ready to be integrated into the game levels.
Course of Events	**1.** Player starts a game level that features U.S. states and capitals as part of the gameplay. **2.** During the level, questions about states and capitals appear, challenging the player to identify them correctly to gain advantages or bonuses in the game (e.g., unlocking special towers, gaining resources). **3.** The player submits answers via an interactive interface. **4.** Feedback is provided immediately, showing correct answers and providing quick facts or mnemonics to aid memory. **5.** Progress is tracked through a visual map or dashboard that shows which states and capitals the player has successfully learned.
Alternative Paths	- For players struggling with certain states or capitals, the game could potentially suggest targeted revision levels or mini-games focusing on their weak areas.
Expectations	- Players enjoy learning through the game and feel motivated to progress to learn all U.S. states and capitals.

	- Interactive elements and immediate feedback help overcome language barriers and enhance learning retention.
Postconditions	- The player has improved knowledge of U.S. states and capitals, which is reflected in their game progress and learning dashboard. - The game has adapted to the player's learning curve, providing more challenging content as their knowledge base grows.